

ZOOLOGY.—*New genera and species of blood flukes from a marine turtle, with a key to the genera of the family Spirorchidae.*¹ EMMETT W. PRICE, Bureau of Animal Industry. (Communicated by BENJAMIN SCHWARTZ.)

Among some trematodes collected by Dr. B. G. Chitwood and the writer from a marine turtle, *Chelone mydas*, which died in the National Zoological Park, March 8, 1932, were a number of specimens belonging to the Spirorchidae, a family proposed by Stunkard (1921) for trematodes occurring in the circulatory system of turtles. These specimens were collected for the most part from washings of the digestive tract, but in view of their affinities with species which have been described from the blood vessels of other cold-blooded hosts, it appears certain that they had escaped from the blood vessels during evisceration; a few specimens were collected also from washings of the body cavities. These specimens were found to represent four new species and three new genera, the descriptions of which are given in this paper. In order to differentiate the new genera from related genera, a key to the genera of the family Spirorchidae is appended.

Neospirorchis, new genus

Generic diagnosis.—Spirorchidae: Body greatly elongated, threadlike, subcylindrical. Cuticula provided with fine transverse ridges but without spines. Oral sucker moderately developed; acetabulum absent. Esophagus, especially the posterior half, surrounded by unicellular glands; intestinal tract similar to that of schistosomes. Genital aperture lateral, in posterior half of body. Testis slender, more or less spiral, extending to intestinal union; vas deferens arising from posterior pole of testis; cirrus pouch present. Ovary slender, spiral, situated along posterior portion of testis. Seminal receptacle and Laurer's canal absent. Vitellaria extending from intestinal bifurcation to near level of genital aperture. Eggs without polar processes. Parasitic in marine turtles.

Type species.—*Neospirorchis schistosomatoides*, new species.

Neospirorchis schistosomatoides, new species

Figs. 1-2.

Description.—*Neospirorchis*: Body threadlike, 7.45 to 9.5 mm. long by about 140 to 220 μ wide; pretesticular portion of body slightly flattened dorsoventrally, posttesticular portion cylindrical or subcylindrical. Cuticula without spines but marked with fine transverse ridges. Oral sucker subterminal, 32 to 40 μ in diameter; acetabulum absent. Esophagus 595 to 680 μ long, consisting of two parts about equal in length; anterior part slender, posterior part about twice the width of anterior part and surrounded by unicellular glands. Intestinal branches slightly sinuous, uniting near level of

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anterior pole of testis, forming a common cecum terminating near posterior end of body. Excretory pore terminal; excretory vesicle Y-shaped. Genital aperture lateral, about 1 to 1.2 mm. from posterior end of body. Cirrus pouch weakly developed, enclosing a long, slender, muscular cirrus; cirrus apparently protrusible, but not actually protruded in any of the specimens available. Vas deferens relatively long and convoluted, arising from posterior pole of testis. Testis long, slender, more or less spiral, and extending anteriorly as far as level of intestinal union. Ovary long, slender, more or less spiral, and extending anteriorly from a point posterior to genital aperture for about one-third the length of testis. Oviduct slender, extending posteriorly to an ootype about 500μ from posterior end of body; oviduct joined here by vitelline duct and continued anteriorly as a slender tube expanding to form the uterus. Seminal receptacle and Laurer's canal absent. Vitellaria well developed, extending in intercecal field from posterior end of esophagus to intestinal union, thence continuing dorsal to common cecum and terminating near level of genital aperture. Vitelline duct single, extending posteriorly to ootype and expanding there to form a large vitelline reservoir. Uterus slightly tortuous, containing 7 to 15 eggs, extending anterior to genital aperture, then turning posteriorly. Eggs oval, 44μ long by 32μ wide, without polar prolongations.

Host.—*Chelone mydas*.

Location.—Visceral blood vessels.

Locality.—United States (Washington, D. C.).

Type specimen.—U. S. N. M. Helm. Coll. No. 32563; paratypes No. 32564.

Neospirorchis schistosomatoides appears to be more or less closely related to *Unicaecum ruszkowskii*, a species described by Stunkard (1925, 1927) from *Pseudemys scripta*, but differs from that species in the form of the digestive tract and in the point of origin of the vas deferens. In *N. schistosomatoides* the digestive tract is of the same type as that found in members of the family Schistosomatidae, while in *U. ruszkowskii* the digestive tract consists of a single cecum. The vas deferens in *N. schistosomatoides* arises from the posterior pole of the testis, while in *U. ruszkowskii* it arises from the anterior pole of the testis, and extends parallel to the testis for its entire length.

The form of the digestive tract in *N. schistosomatoides* is of especial interest, since this is the first species of blood fluke from cold-blooded vertebrates which has a digestive system of the type characteristic for blood flukes occurring in warm-blooded vertebrates. A tendency toward fusion of the intestinal ceca to form a digestive tract of the schistosome type has been reported by Stunkard (1923) in specimens of *Spirorchis*.

Amphiorchis, new genus

Generic diagnosis.—Spirorchidae: Body slender, subcylindrical. Cuticula marked with fine transverse ridges. Oral sucker and acetabulum present. Esophagus slender, surrounded by unicellular glands; intestinal ceca slender, not uniting posteriorly. Cirrus pouch well developed, containing a short cirrus, internal seminal vesicle and prostate cells; external seminal vesicle anterior to cirrus pouch. Testes two in number, one anterior and the other posterior to cirrus pouch and ovary. Seminal receptacle and Laurer's canal

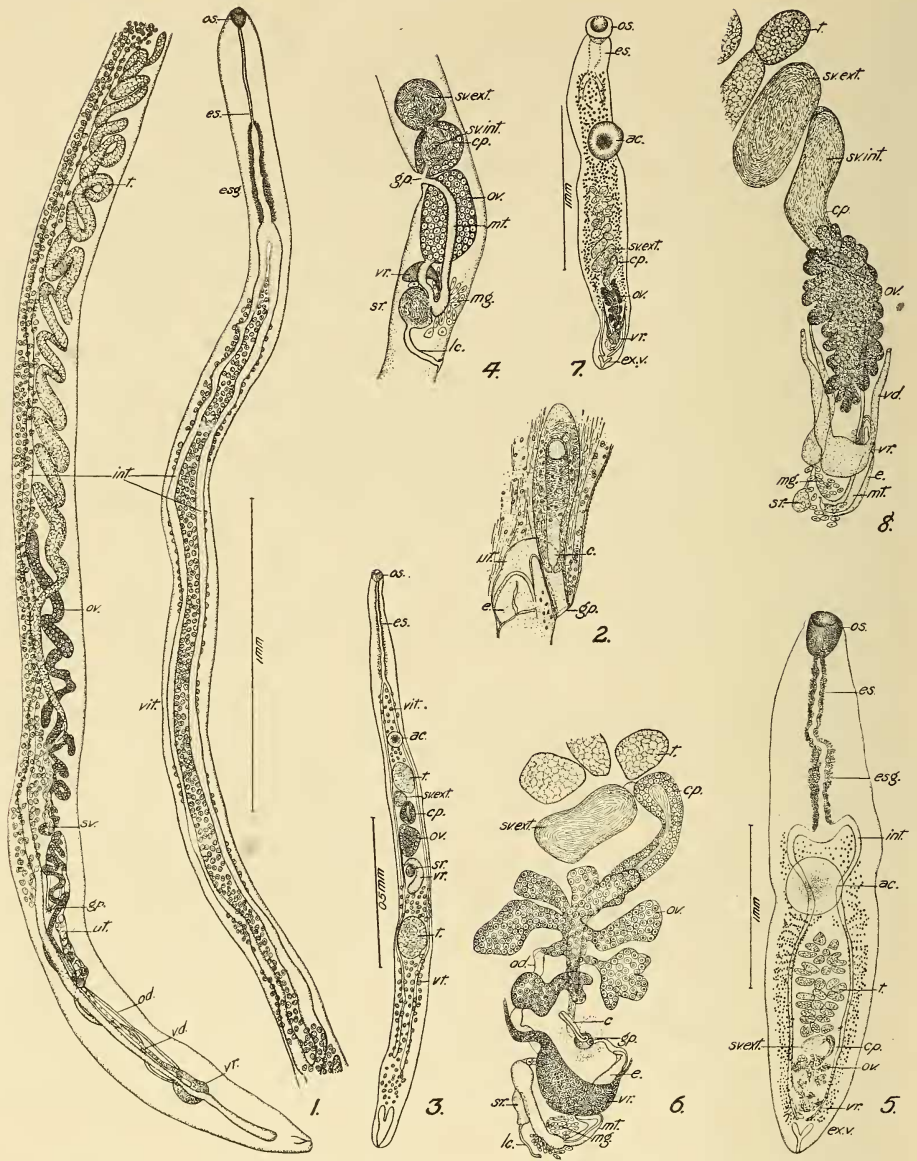


Fig. 1. *Neospirorchis schistosomatoides*. Entire worm. Fig. 2. *N. schistosomatoides*. Terminal portions of genital system. Fig. 3. *Amphiorchis amphiorchis*. Entire worm; ventral view. Fig. 4. *A. amphiorchis*. Genital complex; reconstructed from serial sections. Fig. 5. *Learedius learedi*. Entire worm; ventral view. Fig. 6. *L. learedi*. Genital complex; greatly enlarged. Fig. 7. *L. similis*. Entire worm; ventral view. Fig. 8. *L. similis*. Genital complex; greatly enlarged.

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|--------|-------------------|----------|--------------------------|
| ac. | Acetabulum | mg. | Mehlis' gland |
| c. | Cirrus | mt. | Metraterm |
| cp. | Cirrus pouch | od. | Oviduct |
| e. | Egg | ov. | Ovary |
| es. | Esophagus | sr. | Seminal receptacle |
| esg. | Esophageal glands | sv. ext. | External seminal vesicle |
| ex. v. | Excretory vesicle | sv. int. | Internal seminal vesicle |
| gp. | Genital aperture | t. | Testis |
| int. | Intestine | vit. | Vitellaria |
| lc. | Laurer's canal | vr. | Vitelline reservoir |

present. Vitellaria consisting of two groups of follicles, one group extending from intestinal bifurcation to anterior testis, and the other from posterior end of vitelline reservoir to near posterior end of body. Parasitic in blood vessels of marine turtles.

Type species.—*Amphiorchis amphiorchis*, new species.

***Amphiorchis amphiorchis*, new species**

Figs. 3-4.

Description.—*Amphiorchis*: Body elongated, 1.87 to 2.2 mm. long by 120 to 148 μ wide at level of posterior testis, oval to subcylindrical on cross section. Cuticula without spines but marked by fine transverse striations. Oral sucker subterminal, 40 to 44 μ in diameter; acetabulum circular, 40 to 64 μ in diameter, 476 to 510 μ from anterior end of body. Esophagus 255 to 320 μ long, surrounded by unicellular glands; intestinal ceca slender, terminating blindly about 280 μ from posterior end of body. Excretory pore terminal; excretory vesicle Y-shaped, the branches slightly longer than the stem. Genital aperture median, immediately anterior to ovary. Cirrus pouch oval, 60 to 80 μ long by 48 to 60 μ wide, enclosing a short, thick cirrus, a moderately large internal seminal vesicle, and numerous prostatic cells; external seminal vesicle more or less globular, 40 to 60 μ in diameter, immediately anterior to and slightly to right of cirrus pouch. Anterior testis oval, 100 to 120 μ long by 80 to 88 μ wide, in front of external seminal vesicle; posterior testis oval, 140 to 190 μ long by 100 to 120 μ wide, situated a short distance caudal to posterior end of vitelline reservoir and separated from it by a band of vitelline follicles. Ovary irregularly oval, 120 to 140 μ long by 54 to 80 μ wide, between testes and immediately posterior to cirrus pouch. Seminal vesicle globular, 24 to 40 μ in diameter, posterior to ovary and situated in curve of vitelline reservoir. Mehlis' gland present, consisting of relatively few large cells; Laurer's canal relatively large, opening in mid-dorsal line a short distance posterior to seminal receptacle. Vitelline reservoir large and curved; vitellaria consisting of two groups of follicles, one group between intestinal bifurcation and anterior testis and the other between posterior end of vitelline reservoir and posterior end of body. Metacercum simple, muscular. Eggs not observed.

Host.—*Chelone mydas*.

Location.—Visceral blood vessels.

Locality.—United States (Washington, D. C.).

Type specimen.—U. S. N. M. Helm. Coll. No. 32565, paratypes No. 32566.

The genus *Amphiorchis* appears to be more closely related to the genera *Hapalotrema* Looss, *Spirhpalum* Ejsmont, and *Hapalorhynchus* Stunkard than to any of the other genera of Spirorchidae. *Amphiorchis amphiorchis* is more slender and the testes are simple instead of being divided into pre-ovarial and postovarial groups of follicles as is the case of the types of *Hapalotrema* and *Spirhpalum*. In body form it resembles most closely *Hapalorhynchus gracilis* Stunkard, but in that species the genital aperture is dorsal and the anterior testis is situated posterior to the genital aperture and seminal vesicle, while in *A. amphiorchis* the genital aperture is ventral and the anterior testis is anterior to the seminal vesicle.

Learedius, new genus

Generic diagnosis.—Spirorchidae: Body elongate, slightly constricted equatorially, flattened dorsoventrally. Oral sucker and acetabulum present. Esophagus long and surrounded by unicellular glands; intestinal caeca slender, not uniting posteriorly. Genital aperture median or slightly to left, near posterior end of body. Cirrus pouch present, largely filled by internal seminal vesicle; external seminal vesicle present. Testes numerous, pre-ovarial. Ovary deeply lobed, posttesticular. Laurer's canal present. Eggs with polar prolongations. Parasitic in circulatory system of marine turtles.

Type species.—*Learedius learedi*, new species.

Learedius learedi, new species

Figs. 5-6.

Description.—*Learedius*: Body elongated, 3.4 mm. long by 690μ wide, slightly constricted near equator of body, flattened dorsoventrally. Cuticula with verrucae similar to, but smaller than, those of species of *Schistosoma*. Oral sucker cup-shaped, 280μ long by 240μ wide, oral aperture subterminal; acetabulum circular, 340μ in diameter, pedunculated, near equator of body, Esophagus slightly tortuous, 1.02 mm. long, surrounded by unicellular glands. Intestinal caeca slender, curving inward at level of acetabulum, terminating near posterior end of body. Excretory pore terminal; excretory vesicle Y-shaped, the branches of about the same length as stem. Genital aperture about 360μ from posterior end of body, slightly left of median line. Cirrus pouch shaped somewhat like an elongated letter S, its base enlarged and lying about 360μ from genital aperture, containing a slender internal seminal vesicle, numerous prostate cells, and a protrusible cirrus; external seminal vesicle transversely elongated, 144μ long by 60μ wide, to right of base of cirrus pouch. Testes 28 in number, in intercecal field between external seminal vesicle and acetabulum. Ovary deeply lobed, more or less dendritic, 240μ long by 240μ wide, posterior to external seminal vesicle. Oviduct long and slender, arising at right side of ovary and expanding posteriorly to form an elongated ootype; seminal receptacle postero-dorsal to ootype; Laurer's canal slender, opening in mid-dorsal line near level of ends of caeca. Vitelline reservoir large, anterior to ootype. Vitellaria consisting of small follicles forming a transverse band across body between intestinal bifurcation and level of posterior margin of acetabulum, then extending posteriorly in extracecal fields to level of tips of caeca. Metraterm short and containing a single egg. Egg fusiform, about 210μ long (including polar prolongations) by 28μ wide.

Host.—*Chelone mydas*.

Location.—Circulatory system.

Locality.—United States (Washington, D. C.).

Type specimen.—U. S. N. M. Helm. Coll. No. 32567.

Learedius similis, new species

Figs. 7-8.

Description.—*Learedius*: Body elongated, 2.2 mm. long by 320μ wide, slightly constricted at level of acetabulum. Cuticula with verrucae larger and less numerous than those of *L. learedi*. Oral sucker subterminal, 160μ in diameter; acetabulum circular, 240μ in diameter, pedunculated, about

750 μ from anterior end of body. Esophagus about 170 μ long, surrounded by unicellular glands; intestinal ceca slender, extending to near posterior end of body. Excretory pore terminal; excretory vesicle Y-shaped, the limbs longer than stem. Genital aperture almost median, 260 μ from posterior end of body. Cirrus pouch somewhat S-shaped, its base about 1 mm. from genital aperture, almost completely filled by internal seminal vesicle; external seminal vesicle 180 μ long by 80 μ wide, situated as in *L. learedi*. Testes arranged as in *L. learedi*, the exact number not ascertainable in the specimen available. Ovary lobulated, 260 μ long by 120 μ wide, between external seminal vesicle and vitelline reservoir, ventral to cirrus pouch. Oviduct dilated, arising from right side of ovary; ootype short and surrounded by Mehlis' gland; seminal receptacle present; Laurer's canal not observed. Vitellaria extending from level of intestinal bifurcation to about middle of ovary and occupying entire intercecal field anterior to testes. Egg fusiform, 234 μ long (including polar prolongations) by about 12 μ wide.

Host.—*Chelone mydas*.

Location.—Circulatory system.

Locality.—United States (Washington, D. C.).

Type specimen.—U. S. N. M. Helm. Coll. No. 32568.

The descriptions of *Learedius learedi* and *L. similis* are each based upon a single specimen, but in view of certain distinct differences they cannot be regarded as the same species. These differences are as follows: *L. similis* has a much shorter esophagus and the intestinal bifurcation occurs much farther cephalad of the acetabulum than in *L. learedi*; the testes are much less numerous than in *L. learedi*; the cirrus pouch is relatively much longer and encloses a larger internal seminal vesicle and fewer prostate cells than does that of *L. learedi*; the ovary, while distinctly lobed, does not present the dendritic appearance of that structure in *L. learedi*; and the vitellaria in *L. similis* extend posteriorly only as far as the level of the middle of the ovary, while in *L. learedi* they extend to the level of the tips of the ceca. The egg is also somewhat different in the two species, that of *L. similis* being longer and more slender than that of *L. learedi*.

In addition to the two species just described, *Distoma constrictum* Leared must also be included in the genus *Learedius*. This species was described by Leared (1862) from the "edible turtle" (also referred to in the same paper as the "common turtle"), the specimens having been collected from the heart, and submitted to Cobbold who regarded them as larval flukes. Almost no description was given for this species aside from the size—"Their average length was a line and a half, and the breadth about one third of this,"—and a few minor comments on the shape of the body and on the configuration of the digestive tract. Judging from the figure accompanying the description, the species is closely related to *Learedius learedi* described in this paper and may actually be the same. However, the writer feels that the two forms should be regarded as distinct until such time as a restudy can be made of specimens from the same host and from the same locality as that from which Leared's specimens were obtained. The apparent points of difference be-

tween the two forms are the longer and more serpentine esophagus and the smaller number of testes in Leared's species as compared with these structures in *L. learedi*.

In reviewing the literature concerning *Distoma constrictum* Leared, a situation was discovered which involves the validity of the name of Leared's species as well as of the status of forms subsequently described by Monticelli (1896) and by Looss (1899), which were regarded by them as the same as *D. constrictum* Leared. This situation is briefly summarized as follows:

Distoma constrictum Leared, 1862, is preoccupied by *D. constrictum* Mehlis, in Creplin, 1846, making Leared's *constrictum* a homonym and, consequently, unavailable. This fact was noted by Monticelli (1896) who described under the name of *Mesogonimus constrictus* (Leared) a blood fluke from "*Thalassochelys caretta* Linn." Despite the fact that he noted the priority of names he continued to use the specific name *constrictus* throughout the paper. In his discussion, however, he stated: "Per questo suo caratteristico aspetto, qualora avesse dovuto cambiar nome specifico, il distomide del Leared avrebbe potuto meritare quello *mistroides* (da $\mu\upsilon\sigma\tau\rho\omicron\sigma\omicron\nu$ cucchiaio)." This statement was regarded by Stiles and Hassall (1908) as a renaming of *Distoma constrictum* Leared. Later Looss (1899) proposed the genus *Hapalotrema* for *Mesogonimus constrictus* (Leared) of Monticelli, basing his discussion of this form on material collected by him from the heart of "*Thalassochelys corticata*" at Abukir, Egypt. A comparison of the descriptions and figures given by Monticelli and by Looss, however, show certain differences which suggest that while the forms studied by them are unquestionably congeneric, they probably represent distinct species, and are not the same as, or congeneric with, the species described by Leared. In view of the foregoing, the following points must be considered: (1) The status of *D. constrictum* Leared and of the name *mistroides* Monticelli; (2) the status of the genus *Hapalotrema* Looss; and (3) the identity of *Mesogonimus constrictus* (Leared) of Monticelli and *Hapalotrema constrictum* (Leared) of Looss. The solution of these problems appears to the writer to be as follows:

1. Since *Distoma constrictum* Leared is a homonym it must be renamed, and since the name *mistroides* indicates an anatomical character (spoon-like shape of the body) of the species which Monticelli described as *Mesogonimus constrictus* and which does not apply to Leared's species, the specific name *mistroides* must apply to Monticelli's species. The writer, therefore, proposes for *D. constrictum* Leared the new name *Learedius europaeus*.

2. *Hapalotrema* Looss was proposed as a genus for *Mesogonimus constrictus* (Leared) of Monticelli and applies to that species and not to Leared's species, and since the specific name *mistroides* appears to be the valid name for Monticelli's form, the type of the genus is *Hapalotrema mistroides* (Monticelli, 1896) Stiles and Hassall, 1908 (syn. *Mesogonimus constrictus* (Leared) of Monticelli, 1896; misdetermination).

3. Neither Monticelli nor Looss gave any indication as to the extent of variation occurring in the specimens which they studied, and in view of this

lack of information one must assume that the drawings which they published are representative of the forms which they had before them. A comparison of these drawings shows differences in the number of testes and in the extent of vitellaria, and in body proportions which are as great as, or greater than, those occurring in species of other genera. Monticelli's figure shows 9 testes in the preovarial group and 16 in the postovarial group, whereas in Looss' figure there are 8 in the preovarial group and only 10 in the postovarial group. Monticelli's figure also shows distinctly that the vitellaria unite in the median field anterior to the preovarial group of testes and also posterior to the postovarial group, while in Looss' figure no such union is shown. In Monticelli's figure the oral sucker is of the same size as the acetabulum, while in Looss' figure the oral sucker is about one-third smaller than the acetabulum. There are also noticeable differences in the relative distances between the suckers in the two illustrations, but these may be due to variation in the amount of contraction or extension of the specimens drawn. In view of the disparity as given above the writer feels that for the time being Looss' form should be regarded as a distinct species and proposes for it the name *Hapalotrema loossi* (syn. *Hapalotrema constrictum* (Leared) of Looss, 1899, not *H. constrictum* (Leared) of Monticelli = *H. mistroides* (Monticelli).

Up to the present time the following genera have been included in the family Spirorchidae: *Spirorchis* MacCallum, 1918 (syn. *Proparorchis* Ward, 1921), *Henotosoma* Stunkard, 1922; *Haematotrema* Stunkard, 1922; *Hapalotrema* Looss, 1899; *Hapalorhynchus* Stunkard, 1922; *Vasotrema* Stunkard, 1926; *Unicaecum* Stunkard, 1926; *Spirhapalum* Ejsmont, 1927; *Diarmoschistorchis* Ejsmont, 1927; and *Tremarhynchus* Thapar, 1933. To this family are now added three additional genera, *Neospororchis* n. g., *Amphiorchis* n. g., and *Learedius* n. g. Whether all of these genera should be regarded as valid is a matter of personal opinion. Ejsmont (1927) not only doubts the validity of some species assigned to certain of the above genera but of some of the genera as well. The present writer does not propose to go into the question of the validity of the species at the present time, but so far as the genera are concerned he does not regard *Henotosoma* Stunkard and *Haematotrema* Stunkard as sufficiently different from the genus *Spirorchis* to be considered distinct, the types of the genera, *Henotosoma haematobium* Stunkard and *Haematotrema parvum* Stunkard, becoming *Spirorchis haematobium*, (Stunkard) and *S. parvum* (Stunkard), respectively. *Tremarhynchus indicus*, as described by Thapar (1933), apparently does not differ sufficiently from *Hapalorhynchus gracilis* Stunkard to warrant its separation as a distinct genus, the differences being specific rather than generic; *T. indicus* Thapar, therefore, becomes *H. indicus* (Thapar).

The genera of Spirorchidae fall into two more or less well defined groups, one consisting of monostomatous forms and the other of distomatous forms. Ejsmont, however, has shown that evidence of transition occurs in some of the genera, a fact which makes it undesirable to regard the two groups as

subfamilies. In the genus *Diarmoschistorchis*, which was proposed for a monostomatous species, *Spirorchis blandingi* MacCallum (1926), the testes are arranged in two groups, one group preovarial and the other postovarial; this condition simulates that occurring in species of *Hapalotrema*, which are distomatous. The writer has had the opportunity of examining MacCallum's specimens of this species, and is inclined to regard it as an aberrant form not closely related to the distomatous species. The testes, 12 or 13 of which are preovarial and 3 postovarial, are arranged in a linear series as in the monostomatous species and not irregularly as in the distomatous species; the arrangement of the other organs is the same as in the genus *Spirorchis*. The relation of *Diarmoschistorchis blandingi*, therefore, to such genera as *Haplorchis*, *Amphiorchis*, and others of the distomatous group is questionable. The other example of transition between the two groups, which Ejsmont pointed out, is *Spirhapalum polesianum*; this is a distomatous form which does show definite evidence of transition, especially as regards the egg which is oval and contains a miracidium with eyespots as in the genus *Spirorchis*. Aside from the egg, *S. polesianum* might easily be regarded as congeneric with *Hapalotrema mistroides*, but in the latter species the egg is spindle-shaped and the miracidium is not provided with eyespots. Much might be said regarding the relationships of the genera and families of blood flukes, but such a discussion is not within the scope of this paper.

KEY TO THE GENERA OF THE FAMILY SPIRORCHIDAE

1. Monostomatous forms 2
Distomatous forms 5
2. Testes 2 or more 3
Testis single and spiral 4
3. Testes preovarial *Spirorchis*
Testes both preovarial and postovarial *Diarmoschistorchis*
4. Intestine consisting of a single cecum *Unicaecum*
Intestine consisting of 2 branches uniting near equator of body and forming a common cecum as in the Schistosomatidae *Neospiroorchis*
5. Testes numerous, preovarial *Learedius*
Testes numerous, or single, both preovarial and postovarial, or postovarial only 6
6. Testis single, postovarial; esophageal diverticula present *Vasotrema*
Testes 2 or more, preovarial and postovarial; esophageal diverticula absent 7
7. Testes numerous 8
Testes 2 in number 9
8. Egg oval; miracidium with eyespots *Spirhapalum*
Egg spindle-shaped; miracidium without eyespots *Hapalotrema*
9. Genital aperture dorsal, in front of anterior testis *Hapalorhynchus*
Genital aperture ventral, posterior to anterior testis *Amphiorchis*

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ZOOLOGY.—A new species of the nematode genus *Aphelenchoides* living in sugar cane.¹ G. STEINER, Bureau of Plant Industry.

Aphelenchoides heterophallus n. sp. was observed in a piece of sugar cane stalk originating in Jamaica.² The rind of the cane was a normal green color; the axial portion, however, had a blackish discoloration probably caused by a fungus. It was in this latter portion that a pure culture of the new nematode species was found. *A. heterophallus* is a well characterized form, most closely related to certain species found in the mines of and associated with bark beetles of Europe and the Pacific Northwest. The present case may also involve some association with an insect (most probably a carrier relationship), although the piece of sugar cane stalk exhibited neither mines nor other traces of insects. The complete absence of saprophytic nematode species and of signs of decay seems to exclude the possibility that the infestation was picked up by contact with soil.

The thin cuticle is very obscurely annulated. The anteriorly convex head is well set off. Male and female tails differ in shape, that of the latter being conical and elongated (fig. 1B), and that of the former having a broad, obtuse base with a distinctly set off point (fig. 1D and E). The length of the female tail, however, is quite variable. The head is supported by a cuticu-

¹ Received December 19, 1933.

² Intercepted at the Port of Philadelphia, Pa. by inspector A. B. Wells of the Bureau of Plant Quarantine.